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Designing a Mobile Application for Structured and Flexible Interview Data Collection in the Health Domain

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Abstract—The purpose of this paper is to report on the design of an Android tablet application for data collection by occupational therapists. The design emerged from two design workshops held with users experienced in collecting data on the challenges clients face in using technologies in their daily lives. On the basis of information gathered in the workshops, an Android application was developed for use in clinical and research settings. The aim was to ease the data-collection process and improve data quality by digitizing an existing analogue tool.

Keywords—user involvement, occupational therapy, health information technology, mobile healthcare application

1 Introduction

Mobile health care enables healthcare provision without geographical, temporal, or organizational constraints, which allows higher-quality services to be provided to citizens and widens the coverage area [1], [2]. In other words, health care can be carried out and documented on site using mobile technologies. As such, mobile health care is part of the general digitization of the health domain that has been underway for some time. It relies on communication and the use of various software applications for diagnosing and medical calculation purposes, and provides access to information resources and information systems [3]. The expected and documented benefits of digital health care include improved safety, reduced costs, higher quality, and fewer errors [4]–[6]. However, the field has also experienced challenges, especially in relation to design and implementation. These challenges include questions about reliability, a lack of usability, adoption issues, and a lack of user involvement in design and development [3], [4], [7]. Although the digitization of health care holds great potential, it should be carefully developed and implemented.

Mobile health care has a variety of goals, such as disease prevention, monitoring, remote care, decision-making support, and emergency intervention [8]. Varshney [8] classifies mobile-health applications in terms of whether they are user or provider

centric, and whether they are automated or human assisted. In recent years, the range of self-reporting health-related mobile applications has increased. Individuals can monitor and track their own health using mobile applications (e.g., pulse, movement, exercise), and applications can guide individuals' health-related decisions (e.g., walk more, eat less).

The mobile health application addressed in this paper originated from an established, paper-based tool used in occupational practice and research to collect data on clients' use of technologies in their daily lives. The tool is used to identify a client's perceived difficulties with those technologies and whether those technologies are relevant to the focal client [9], [10]. The data collected using the tool are important for determining a client's ability to independently carry out a range of activities in everyday life. As the tool is commonly used with clients suffering from cognitive impairment, such as dementia, self-reporting is not an option. Furthermore, the tool requires a semi-structured conversation between the occupational therapist and the client and contains questions grouped into seven topics. It covers a total of 90 technologies. Due to the focal client group and the tool's complexity, the tool was developed to be handled by professional data collectors.

In its original form, the tool consisted of 13 pages that were printed and filled out by the data collector during a conversation with the client. The intentions of transforming the tool to a digital form were to increase flexibility in the tool's use and to improve the data quality by, for example, eliminating the risk of errors when transferring data from paper to clients' journals or when using the data in situations requiring team collaboration.

2 Related work

Mobile technologies have gained some attention in occupational therapy. Most applications have been developed to enable clients to report observations and information for future interventions with therapists. Recent examples include Almeida et al.'s [11] application for the self-management of psychotic disorders and Svarre et al.'s [12] application for identifying barriers in clients' homes.

The use of standardized instruments for collecting client data is common in occupational therapy [12]. However, the tools are rarely available in digital form. Thus, little research to date has focused on mobile health solutions targeting occupational therapists and their collection of data for documentation purposes. In general, mobile health care has gained a lot of attention in a variety of medical fields [13], also in terms of professionals' usage [14]. In this regard, solutions range from mobile applications focused on a specific aspect of health to applications providing access to health-record systems from a distance. The aims of such applications are to provide clinical support, health-worker support, and helpline functions, and enable remote data collection [15]. The expectation is that occupational therapy, which generally involves numerous home visits, would benefit from a move toward mobile health care, as has been the case in many other areas in the health domain.

3 Methodology

Design workshops were used to gain an understanding of users' requirements for the future mobile application. Two design workshops were held in the early stages of the development process (December 2015). As the workshops were to take place in Stockholm, we invited participants who lived within a reasonable distance of the city. Two types of participants took part in the workshops. One group had experience in using the original tool for data collection for research purposes (six participants), while the second group was experienced in using it in clinical practice (three participants). As the tool was most commonly used in Sweden at the time of the workshops, all participants were Swedish.

At the beginning of the workshops, all participants completed informed consent forms. The workshops were based on fictional narratives [16]—a thorough discussion of the structure of the workshops can be found in Svarre and Lunn [17]. The workshops and participant interactions were captured on video, dictation machine, and pictures to allow for analysis. After the workshops, the sound files were transcribed by an external transcriber. The transcripts were then subjected to meaning condensation and coding [18] with the purpose of identifying likely challenges, potential, differences of opinion, and requirements for the future application. The analysis led to the delineation of the requirements listed in Section 4.

Subsequently, we started developing design proposals for the mobile application. Throughout the development process, we worked closely with an IT company that was in charge of programming the application. The process was iterative, as it involved continuous alternations between programming and idea generation from the project group.

4 Application requirements

The two workshops served the purpose of identifying the challenges and strengths of the paper version of the tool along with general design ideas. The requirements emphasized by the workshop participants, which are presented in Table 1, ranged from generic observations to highly specific issues, problems, and ideas.

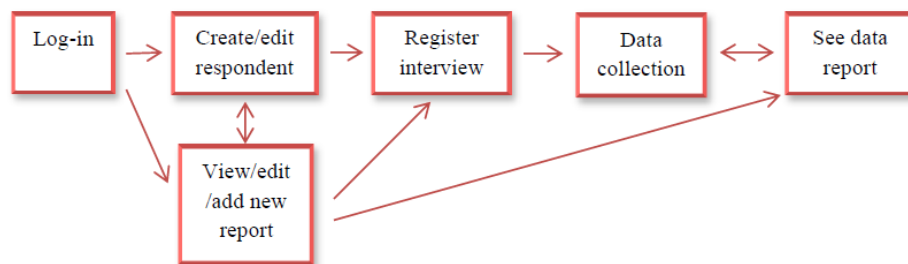
The workshops also highlighted problems concerning the general understanding and use of the tool, the correct use of the relevance criteria as an interviewer, and the amount of the time required for the tool's use. These issues were related to the generic form of the tool and would not be affected by digitization. Other issues, such as the possibility of combining the tool with other tools, establishing a hierarchy of everyday technology items, and introducing supporting questions were related to development focused on usage rather than development of the application itself. Issues that were beyond the scope of the application's development do not appear in the table.

Table 1. Summary of characteristics, user suggestions, and design solutions

Issues/strengths/weaknesses/ characteristics/design ideas (in relation to original tool)	User suggestion	Design solution
Structured to guide a personal conversation	Focus on the dialogue and make room for the client	Navigation structure should be simple and flexible
Omit irrelevant items	Only score items relevant to the client	No requirement to complete all items and easy scoring
Time consuming	Rating all items requires a significant amount of time	
Many items to keep track of	Remind of unintentionally omitted items	Visual reminders of empty items during data collection and in the report window
No summary of findings	Sum up the results in a report	Visual presentation of results
Esoteric results	Ease dissemination to clients and colleagues	Enable export of client report in digital format
Manual coding errors	Risk of coding errors when data are transferred from paper to database	
Easy to lose track of the work flow	Need to move between issues as the interview progresses	Ease navigation and ability to change ratings
Data and results can be compared for the same client	Digital comparison of different reports for the same client	After the client is registered, several reports can be generated and compared
Available in different languages	Easy switching among languages	Integrate Swedish, English, and Danish language options

5 Application design

The application, which was developed for Android tablets, is structured as shown in **Error! Reference source not found.** At first glance, the model appears linear, but the application's interface enables users to complete the various elements as they work their way through the interview.

**Fig. 1.** Content elements of the application

For data-safety reasons, users must log in before they can use the application. Thereafter, they can create a new respondent or retrieve existing respondents. The

data registered in this interface reflect the data specified in the original tool (e.g., gender, age, occupation). In addition, each interview session is registered to allow users to distinguish among numerous interviews when needed. Subsequently, data are collected on the respondents' difficulties with using technologies in their daily lives. For data collection, the items are grouped into seven topics to provide an overview of the items and an indication of how far the user has advanced in the interview process. On the left-hand side of the interface, a checkmark indicates when a topic has been completed (see illustration in **Error! Reference source not found.**), while fractions indicate how many items are completed within each topic.

Fig. 2. The application's data-collection interface

The right-hand side of the data-collection interface shown in **Error! Reference source not found.** lists the items contained within a given topic. To address the workshop participants' requirement that the tool be simplified, an item only unfolds and asks for additional specifications of a technology's use if the user has indicated that the technology in question is being used.

In the report interface, the distribution of items and their degrees of difficulty, relevance, and use are illustrated (see **Error! Reference source not found.**). The report design is inspired by the workshops, where it became evident that clarity was important. In response to user requirements, the distribution can be viewed for a single topic or across all topics.

The flexibility requested in the workshops is incorporated in the application in different ways. For example, as illustrated in **Error! Reference source not found.** and 3, the user can move among various windows while filling out items during an interview. When needed, the user can complete one or more items, go to the report window for a preliminary view of item distribution, and return to the data-collection window to complete more items. In addition, existing reports are available to the user, who can add a new report to an existing respondent or edit an existing report when needed.

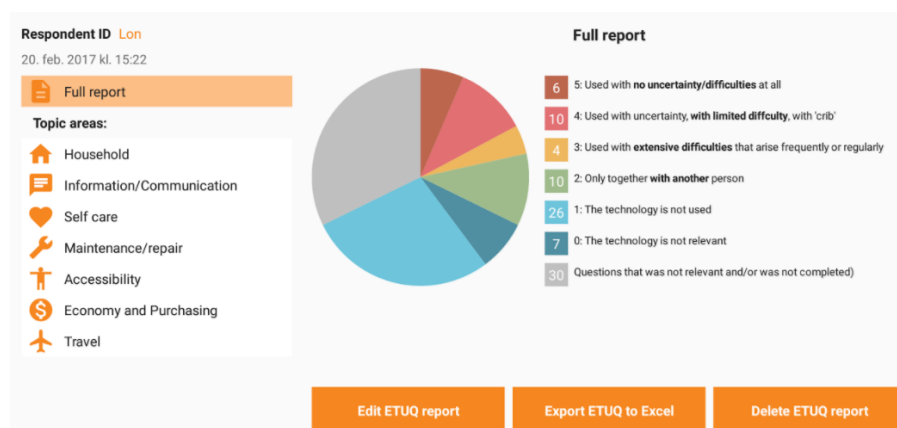


Fig. 3. The application's report interface

6 Discussion and future work

The design presented above reflects the tension between designing from a known tool, as is the case here, and designing from scratch. The digitization of a tool that is already in use may limit the users, as they are restricted by the limits and format of the existing tool. However, as users have experience with the tool, they may be able to avoid the tool's known inconveniences and, thereby, end up with a stronger solution.

The work presented here reflects the initial design of a mobile application for researchers and occupational therapists in their everyday work with clients. The application was designed on the basis of information gathered during two design workshops involving current users of the paper-based version of the tool. The application is currently in testing in clinical practice with the aim of extending our knowledge of its possibilities, limitations, and applicability in interactions among therapists, clients, and mobile units. Follow-up studies should be carried out to broaden our understanding in this regard. These studies can, for example, focus on the report, which is a new feature. Moreover, attention should be paid to the data-security element and to ways in which the data can be integrated with existing systems used for research and municipal administration.

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